

# OREGON NANOSCIENCE AND MICROTECHNOLOGIES INSTITUTE

## **From (nano)Technology Push to Market Pull: the ONAMI Model**

Nanomanufacturing Summit 2013

Track: Research Centers- The Role of Innovation

*Philadelphia, PA      October 16, 2013*

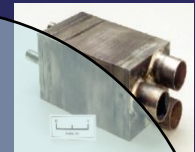
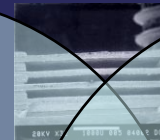
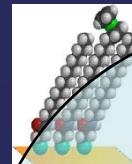
**Robert D. "Skip" Rung**  
**President and Executive Director**



ONAMI

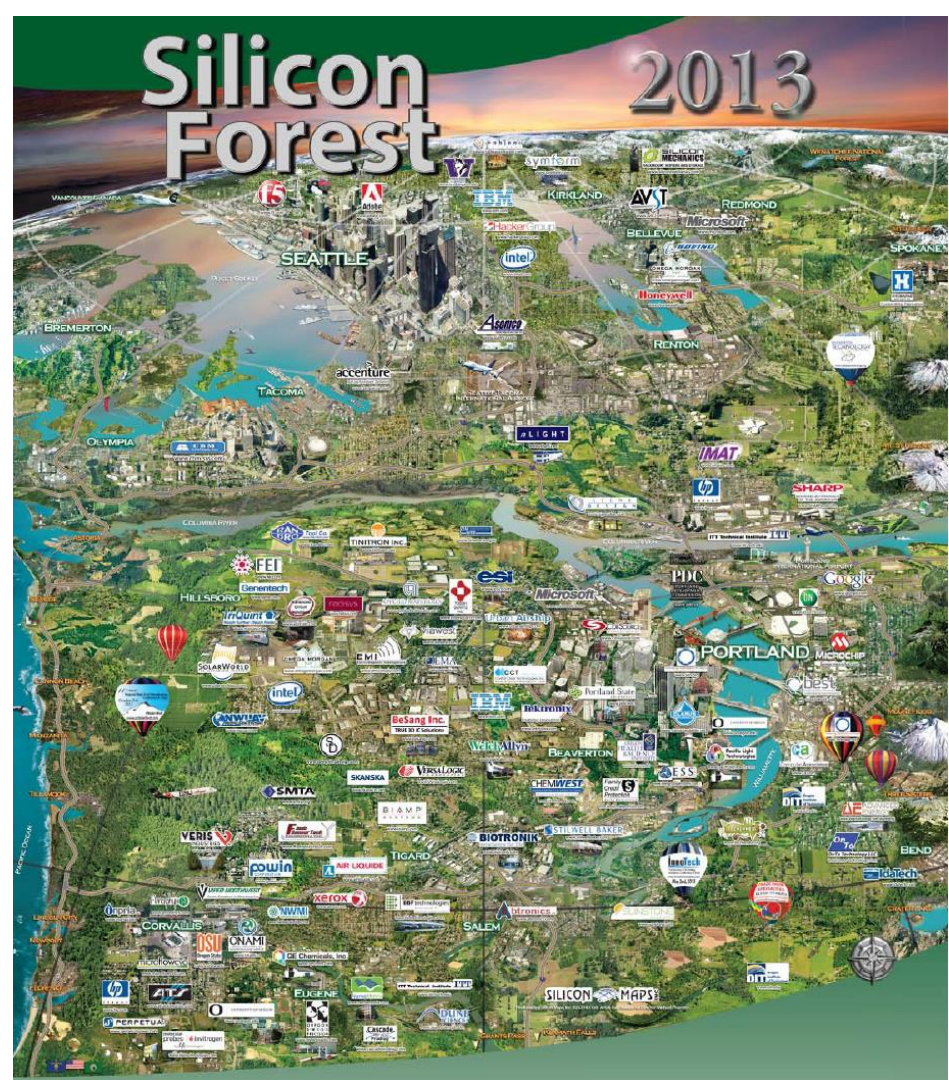
# Signature Research Center Investment Formula

*OECD's 2002 study pointed to: "multiscale materials and devices" = Nanoscience & Microtechnologies*





# Pacific Northwest Micro and Nano Industry Assets



10 regional maps (2 PNW, 3 CA,  
MA, DC/East, TX, AZ, FL) at  
[www.siliconmaps.com](http://www.siliconmaps.com)

# ONAMI

OREGON NANOSCIENCE AND  
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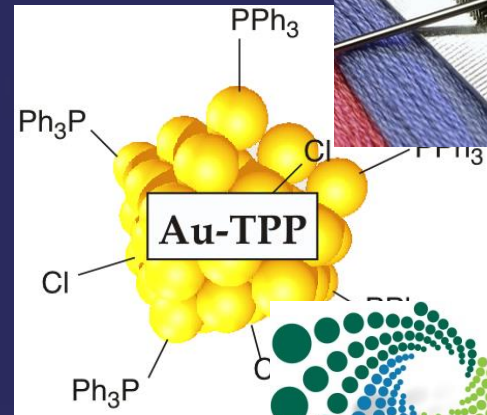
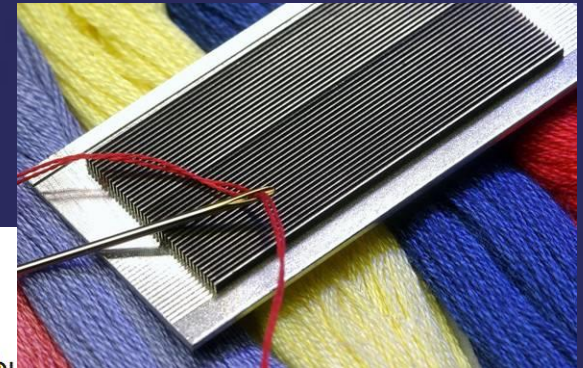
# Identified Research Strengths

- **Microtechnology-based Energy and Chemical Systems**

- **Green Nanomaterials and Nanomanufacturing**

- **Nanolaminates and Transparent Electronics**

- **Nanoscale Metrology and Nanoelectronics**





# ONAMI 3-Part Model and Metrics

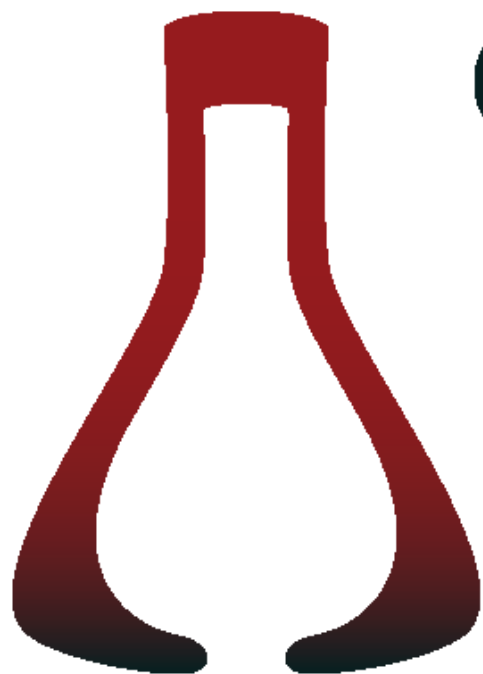
- ③ Grow technology and talent development at Oregon research universities  
***Metric: Federal and private awards and contracts***
- ③ Support research collaboration, industry and start-ups with accessible shared facilities and tools  
***Metric: # of external clients, service revenue***
- ③ Attract capital to Oregon start-ups via a professionally managed commercialization gap fund  
***Metric: #FTE employed, leveraged capital investment and grant \$\$***

**State of Oregon Investment in ONAMI:  
\$53M to-date (\$20M capital, \$33M operating)**

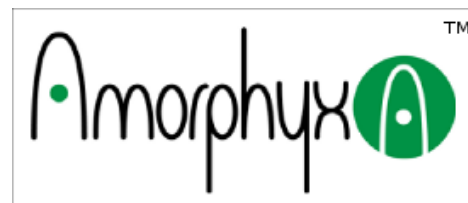
# This is Actually Working...



 Metrics...

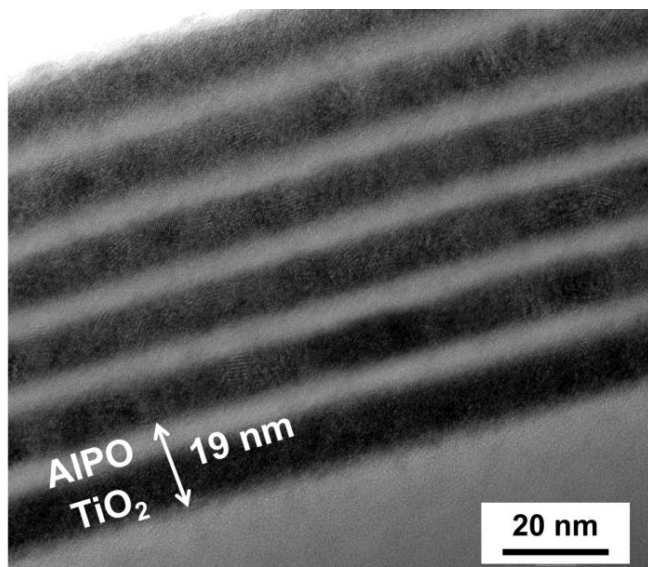


# center for sustainable materials chemistry



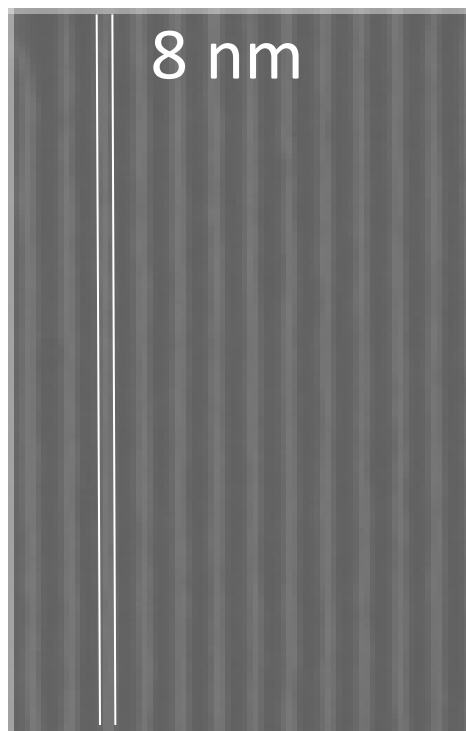
[sustainablematerialschemistry.org](http://sustainablematerialschemistry.org)

# Toward Manufacturing Laminates

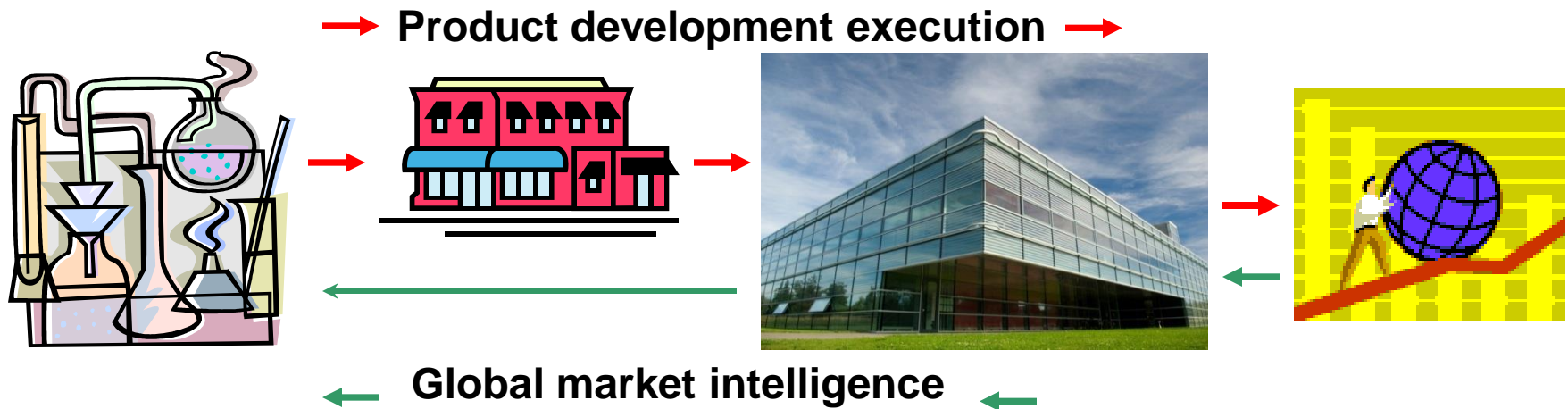




# Breaking Barriers in Resolution



Line roughness < 1 nm



## So what is the “Innovation Ecosystem”?

**Research Institutions:** scientific discovery, fundamental invention, talent development, shared user facilities. **Need:** public and philanthropic funding

**Startup companies:** pioneering development of small - but disruptive – first opportunities. **Need:** equity/royalty licenses, large company customers/partners, high-risk (seed, A, B) capital, supportive tax/regulatory environment

**Large companies:** Manufacturing scale-up and global business development. **Need:** large & profitable “mainstream” markets, low-risk technology options

**Governments:** Infrastructure, optimum tax/reg structure, public safety. **Need:** Growing tax base; engaged, informed and healthy citizenry

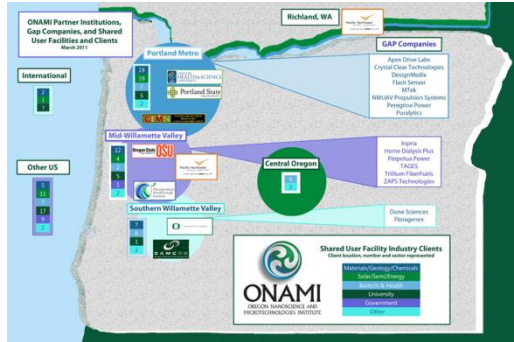


# The “High Tech Extension” Concept

Nanoscience facilities and equipment can best benefit technology development when they are conveniently located and easy to use by businesses. **Such access is especially important to the small and medium enterprises (SMEs) that are critical for early stage commercialization.** State and regional economic development field staff can serve as “high tech extension” agents.



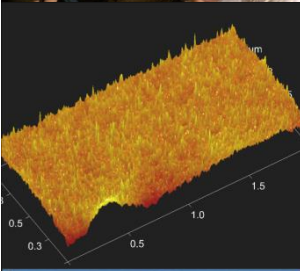
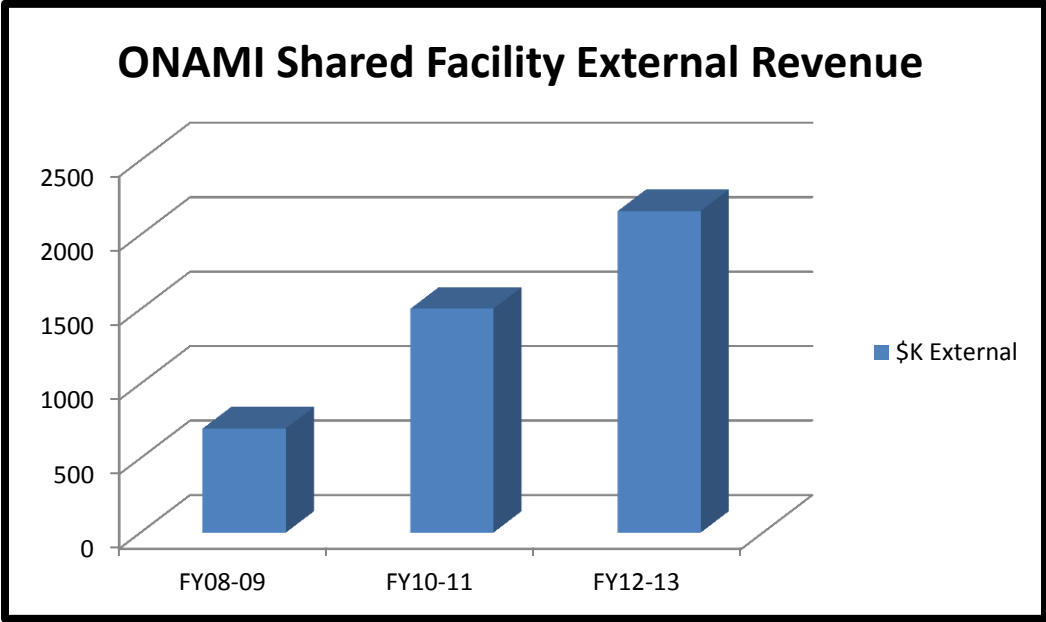
# An Established Service Network



**External Users Served:**

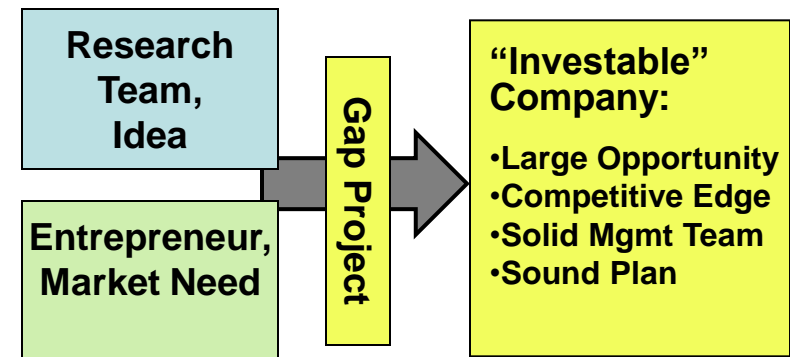
**FY12-13: 161**

**Cumulative: 242**



# ONAMI Commercialization Gap Fund Concept

Technology Stage	Company Stage	Funding Source
Research Result	(NA)	Research Grants
<b><i>Proof of Concept to Product</i></b>	<b><i>Formation, Value Proposition</i></b>	<b><i>Gap Funding SBIR/STTR</i></b>
Products, Sales	Development	Early Stage Investors
Product Line Expansion	Growth	Various (private)



***There are really TWO gaps:***  
 Technology/product maturity  
 Transition from Technology Push to Market Pull

# ONAMI Entrepreneurs In Residence

*Team, Network, Market and Sales assistance from veteran CEOs*

🌀 Augie Sick [asick@onami.us](mailto:asick@onami.us)

- *Chemistry, nanomaterials, life science tools*



🌀 Michael Tippie [mtippie@onami.us](mailto:mtippie@onami.us)

- *Biomedical, pharma, nanomedicine*



🌀 John Brewer [jbrewer@onami.us](mailto:jbrewer@onami.us)

- *Semiconductors, electronics, optics*





**19 of 31  
ONAMI Gap  
Fund Portfolio  
Companies  
have been  
SBIR/STTR  
awardees**



## GAP Company Portfolio

### Water

Crystal Clear Technologies  
MTEK Energy Solutions  
Puralytics  
ZAPS Technologies

### Bio and Health Care

Artielle  
Cascade Prodrug  
DesignMedix  
Floragenex  
Flash Sensor  
Home Dialysis Plus  
Northwest Medical Isotopes  
NemaMetrix  
PDX Pharma  
Valliscor

**132 FTE**

### Energy














Applied Exergy  
Energy Storage Systems  
Mtek  
NWUAV  
Perpetua Power  
Trillium FiberFuels  
Element One

### Advanced Materials

Amorphyx  
CNXLs  
CSD Nano  
Dune Sciences  
Inpria  
Microflow CVO  
OnTo Technology  
Pacific Light Technologies  
QE Chemical  
Voxtel Nano  
Supra Sensor

**\$119.5M leverage to date, more pending**

# A Green Nano Startup Portfolio

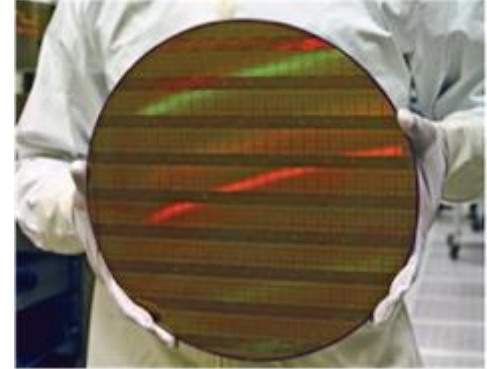
 <b>SNNI</b>	Green Nano-Material	Green Nano-Manufacture	Green Nano Application
Safer Design			
Reduce e-impact			
Waste Reduction			
Process Safety			
Materials Efficiency			
Energy/H2O Efficiency			  

# Applications

Display Backplane  
TFT Materials



Lithography  
Materials



**inpria**

Materials And  
Processes

Thin Film PV



Window Coatings



Printed Electronics & Lighting





# Amorphyx Overview

- Breakthroughs in manufacture and use of amorphous metals
- Revolutionize manufacturing of flat-panel display backplanes while enabling the future of flexible displays

Replaces complex Thin Film Transistor with simpler Amorphous Metal Electrode Thin Film Diode

Roughly 3x capacity increase in TFT Array manufacturing facilities using existing tooling

- License AMTFD Process into FPDs
- Develop Reference Plant for Flexible

Convert \$Bs in annual FPD industry losses into profits by redefining backplane manufacturing throughput



Generation 8 glass panel patterned with six backplanes for 52" Samsung televisions. Previous generation glass panels are seen to lower left.



## All-Iron Hybrid Redox Flow Batteries for commercial, industrial and utility applications

### Why Energy Storage?

- Peak period energy tariffs are 400% higher than low-cost nighttime rates in many areas
- \$7.5B market for energy storage in California

### The ESS Advantage

- Reduce electricity expenditures by 33%
- Increase energy reliability and maintain operations through power outages
- Fully amortized system cost of \$270 /kW >\$1000 /kWh for commercially available

### Scalable & Cost Effective: Ideal for Grid Storage

Adjusting cell count customizes power output

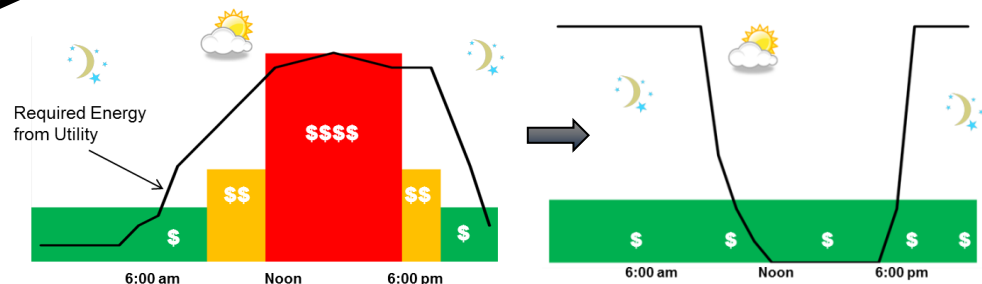
Fine-tuning electrolyte volume increases storage capacity



**\$1.725 ARPA-E SBIR  
Awarded August 2, 2012**

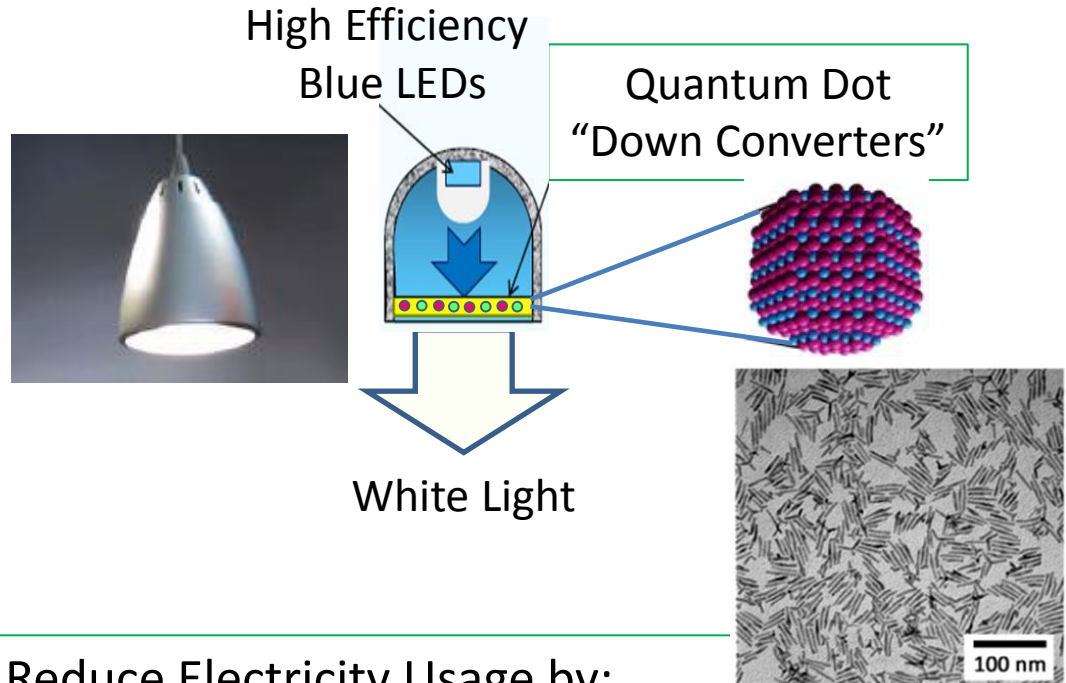


### Energy Consumption to Local Tariff Structures



# Pacific Light Technology

*efficient lighting through engineered nanomaterials*



SSL Bulbs Today Reduce Electricity Usage by:

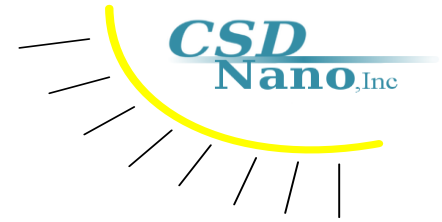
- 80% vs. Filament Bulbs (But initial price is 2-3x too high)
- 10-20% vs. Florescent (Not sufficient)

PLT's High Efficiency QD Down Converters Will:

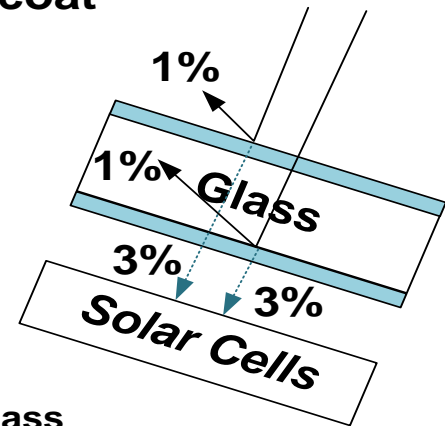
- Reduce Cost by Reducing Number of LEDs (20-50%)
- Reduce SSL "Florescent" Electricity Usage by another 20-50%
- Improve Stability of Color (no objectionable CFL color "shifts")



# ARC\* Moth-eye Structure

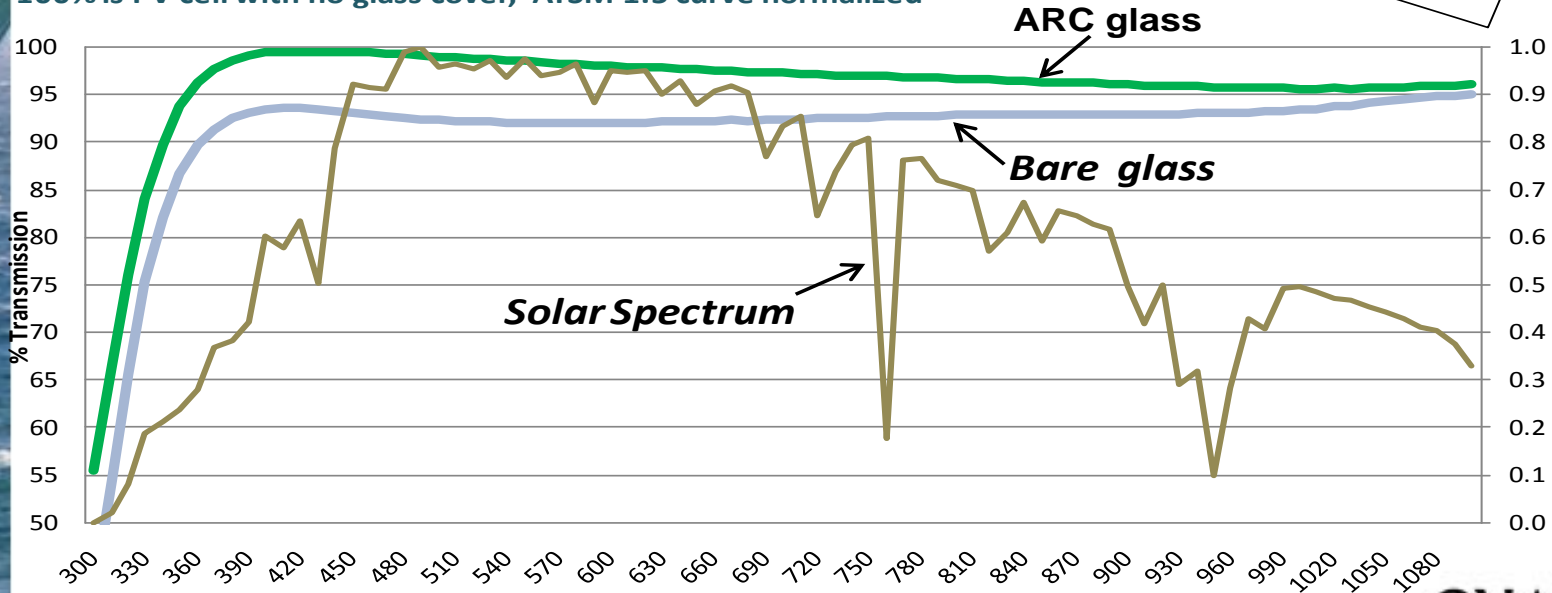


- \* Moth-eye structure (<100nm) with polymer hard coat
- \* Average 5.85% increase across 400nm-750nm (3<sup>rd</sup> party measured, 12 Eagle 2000 solar cover glass)
- \* Excellent broadband and angle of incidence performance without extra film layers



## Percent Transmission (%T)

100% is PV cell with no glass cover, ATSM 1.5 curve normalized



info@csdnano.com



# SBIR/STTR and State Initiatives Are Highly Complementary

	SBIR-STTR	State Gap Funding
Financial Resources	★	✘
Domain Expert Review	★	✘
National Prestige/Exposure	★	✘
Feder	<p style="text-align: center;"><i>Could federal agencies and states collaborate to get the best of both worlds?</i></p>	
Real-t		
Econo		
Mana		
Busin		

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*Thank You!*

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**ONAMI**